watts/meter °K, and more preferably at least about 13 watts/meter °K. In addition, it is economical to produce because it can be produced using currently available methods and equipment.

While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitations.

We claim:

1. An apparatus comprising:

an electrochemical cell electrically conductive support comprising

a conductive core comprising an active area; and

an electrically and thermally conductive polymeric composite substantially covering the active area of the conductive core.

2. An apparatus according to Claim 1, wherein the thermally conductive core comprises a metal or metal alloy.

3. An apparatus according to Claim 2, wherein the metal or metal alloy is selected from the group consisting of aluminum, copper, magnesium, and combinations thereof.

4. An apparatus according to Claim 1, wherein the electrochemical cell electrically conductive support additionally comprises at least one channel for conducting a fluid.

5. An apparatus according to Claim 4, wherein the at least one channel is an exterior channel for conducting fuel gas, fuel liquid, oxidant gas or oxidant liquid.

6. An apparatus according to Claim 4, wherein the at least one channel is an interior channel for conducting cooling fluid.

7. An apparatus according to Claim 1, wherein the conductive core additionally comprises a heat transfer area extending beyond the active area.

8. An apparatus according to Claim 7, wherein the heat transfer area is in the form of a cooling fin.

9. An apparatus according to Claim 1, wherein a thermal coefficient of expansion of the conductive core is substantially the same as a thermal coefficient of expansion of the electrically and thermally conductive polymer composite, over an operative temperature range of the fuel cell.

10. An apparatus according to Claim 1, where volume resistivity of the electrically conductive polymer support is less than about 0.5000 ohm-cm.

11. A system comprising:

a plurality of electrochemical cell electrically conductive supports comprising

a conductive core comprising an active area; and

an electrically and thermally conductive polymer composite substantially covering the active area of the conductive core;

gas supply means for supplying fuel gases and oxidant gases to the fuel cell membranes;

electrical means for transporting electrical charge to and from the fuel cell membranes;

electrical means for conditioning power produced by the plurality of fuel cell membranes; and

control means for controlling the fuel gases, oxidant gases and electrical means.

12. A system according to Claim 11, wherein at least one substrate has interior channels for channeling a cooling fluid.

13. A system according to Claim 12, further comprising means for supplying cooling fluid to the interior channels.

14. A system according to Claim 11, wherein the conductive core additionally comprises a heat transfer area extending beyond the active area.

15. A system according to Claim 11, further comprising means for supplying cooling fluid to the heat transfer area.

16. A system according to Claim 15, wherein the cooling fluid is air.

17. An apparatus, comprising

an electrochemical cell electrically conductive support comprising

a conductive core comprising an active area; and

an electrically and thermally conductive polymeric composite substantially covering the active area and adhered thereto by an adhesion promoter.

18. The apparatus of Claim 17, wherein the adhesion promoter is a silane, titanate, or zirconate adhesion promoter.

19. The apparatus of Claim 17, wherein all or part of the conductive filler is in the form of fibers, platelets, or a combination of fibers and platelets.

20. The apparatus of Claim 17, wherein the conductive support has a volume resistivity of about 0.116 ohm-cm or less.

21. The apparatus of Claim 17, wherein the conductive support has a thermal conductivity of at least about 5 watts/meter °K.

22. The apparatus of Claim 17, wherein the conductive polymer composite when molded has a linear shrinkage per unit length of the molded composite in the X-Y plane of less than or equal to about 0.005.

23. The apparatus of Claim 17, wherein the conductive core comprises metals selected from the group consisting of aluminum, aluminum alloys, nickel, nickel alloys, copper, platinum, magnesium, magnesium alloys, titanium, gold plated metals, and stainless steel.

24. The apparatus of Claim 23, wherein the conductive polymer composite is a polybutadiene- or polyisoprene-based composite.

25. The apparatus of Claim 24, wherein the adhesion promoter is chemically bonded with both the conductive core and the conductive polybutadiene- or polyisoprene-based composite.

26. The apparatus of Claim 24, wherein the adhesion promoter is a mercapto-functional silane or vinyl silane.

27. The apparatus of Claim 24, wherein the conductive polybutadiene- or polyisoprene-based composite comprises a conductive filler, a thermosetting polybutadiene or polyisoprene resin and an unsaturated butadiene- or isoprene-containing polymer capable of participating in cross-linking with the polybutadiene or polyisoprene resin during cure, and further wherein the volume to volume ratio of the polybutadiene or polyisoprene resin to the unsaturated butadiene- or isoprene-containing polymer is between 1:9 and 9:1, inclusive.

28. The apparatus of Claim 27, wherein the conductive polybutadiene- or polyisoprene-based composite further comprises a functionalized liquid polybutadiene or polyisoprene resin.

29. The apparatus Claim 27, wherein the conductive polybutadiene- or polyisoprene-based composite comprises, based on the total coating, about 10 volume % to about 90 volume % of the filler.

30. The apparatus of Claim 27, wherein the filler is synthetic graphite.

31. The apparatus of Claim 27, wherein the conductive polybutadiene-or polyisoprene-based composite further comprises at least one monomer with vinyl unsaturation.

32. The apparatus of Claim 31, wherein the at least one monomer with vinyl unsaturation is selected from the group consisting of styrene, vinyl toluene, divinyl benzene, triallylcyanurate, diallylphthalate, and multifunctional acrylate monomers.

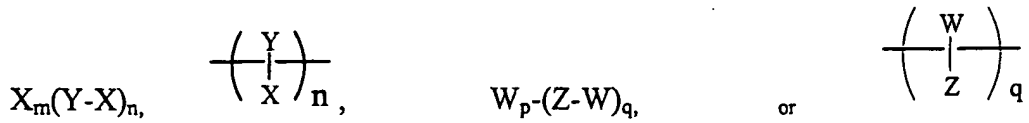
33. The apparatus of Claim 27, wherein the unsaturated butadiene- or isoprene-containing polymer is a copolymer of isoprene or butadiene and a second monomer.

34. The apparatus of Claim 33, wherein the unsaturated butadiene- or isoprene-containing copolymer is solid.

35. The apparatus of Claim 33, wherein the unsaturated butadiene- or isoprene-containing polymer is a block copolymer.

36. The apparatus of Claim 35, wherein the unsaturated butadiene-or isoprene-containing polymer is a styrene-butadiene or a methyl styrene-butadiene di-block polymer.

37. The apparatus of Claim 35, wherein the unsaturated butadiene- or isoprene-containing polymer is a thermoplastic elastomer block copolymer having one of the formula



wherein each formula Y is a block comprising isoprene or butadiene units, X is a thermoplastic block, and m and n represent the average block numbers in said copolymer, m being 0 or 1 and n being at least 1; and Z is a polyethylene or ethylene-propylene copolymer block, W is thermoplastic block, and p and q represent the average block members in said copolymer, p being 0 or 1 and q being at least 1.

38. The apparatus of Claim 24, wherein the polybutadiene or polyisoprene resin has a molecular weight of less than 5, 000.

39. The apparatus of Claim 23, wherein the conductive polymeric composite comprises epoxidized phenol novolac resin, epoxidized cresol novolac resin, polymers based on unsaturated vinyl esters, and combinations comprising at least one of the foregoing resins.

40. An electrochemical cell component comprising;

a conductive core; and

an electrically and thermally conductive polymer composite substantially covering and adhered to the core by an adhesion promoter, wherein the electrochemical cell component has a volume resistivity of about 0.116 ohm-cm or less.

41. The component of Claim 40, wherein the adhesion promoter is a silane, titanate, or zirconate adhesion promoter.

42. The component of Claim 40, wherein all or part of the conductive filler is in the form of fibers, platelets, or a combination of fibers and platelets.

43. The component of Claim 40, wherein the conductive support has a thermal conductivity of at least about 5 watts/meter °K.

44. The component of Claim 40, wherein the conductive polymer composite when molded has a linear shrinkage per unit length of the molded composite in the X-Y plane of less than or equal to about 0.005.

45. The component of Claim 40, wherein the conductive core comprises metals selected from the group consisting of aluminum, aluminum alloys, nickel, nickel alloys, copper, platinum, magnesium, magnesium alloys, titanium, gold plated metals, and stainless steel.

46. The component of Claim 45, wherein the conductive polymer composite is a polybutadiene- or polyisoprene-based composite.

47. The component of Claim 46, wherein the adhesion promoter is chemically bonded with both the conductive core and the conductive polybutadiene-or polyisoprene-based composite.

48. The component of Claim 46, wherein the adhesion promoter is a mercapto-functional silane or vinyl silane.

49. The component of Claim 46, wherein the conductive polybutadiene- or polyisoprene-based composite comprises a conductive filler, a thermosetting polybutadiene or polyisoprene resin and an unsaturated butadiene- or isoprene-containing polymer capable of participating in cross-linking with the polybutadiene or polyisoprene resin during cure, and further wherein the volume to volume ratio of the polybutadiene or polyisoprene resin to the unsaturated butadiene- or isoprene-containing polymer is between 1:9 and 9:1, inclusive.

50. The component of Claim 49, wherein the conductive polybutadiene- or polyisoprene-based composite further comprises a functionalized liquid polybutadiene or polyisoprene resin.

51. The component of Claim 49, wherein the conductive polybutadiene- or polyisoprene- based composite comprises, based on the composite, about 10 volume % to about 90 volume % of the conductive filler.

52. The component of Claim 49, wherein the filler is synthetic graphite.

53. The component of Claim 49, wherein the conductive polybutadiene-or polyisoprene-based composite further comprises at least one monomer with vinyl unsaturation.

54. The component of Claim 53, wherein the at least one monomer with vinyl unsaturation is selected from the group consisting of styrene, vinyl toluene, divinyl benzene, triallylcyanurate, diallylphthalate, and multifunctional acrylate monomers.

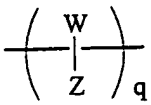
55. The component of Claim 49, wherein the unsaturated butadiene- or isoprene-containing polymer is a copolymer of isoprene or butadiene and a second monomer.

56. The component of Claim 55, wherein the unsaturated butadiene- or isoprene-containing copolymer is solid.

57. The component of Claim 55, wherein the unsaturated butadiene- or isoprene-containing polymer is a block copolymer.

58. The component of Claim 57, wherein the unsaturated butadiene- or isoprene-containing polymer is a styrene-butadiene or a methyl butadiene-butadiene di-block polymer.

59. The component of Claim 57, wherein the unsaturated butadiene- or isoprene-containing polymer is a thermoplastic elastomer block copolymer having one of the formula

$X_m(Y\text{-}X)_n$,  , $W_p\text{-}(Z\text{-}W)_q$, or 

wherein each formula Y is a block comprising isoprene or butadiene units, X is a thermoplastic block, and m and n represent the average block numbers in said copolymer, m being 0 or 1 and n being at least 1; and Z is a polyethylene or ethylene-propylene copolymer block, W is thermoplastic block, and p and q represent the average block members in said copolymer, p being 0 or 1 and q being at least 1.

60. The apparatus of Claim 45, wherein the conductive polymeric composite comprises epoxidized phenol novolac resin, epoxidized cresol novolac resin, poly(diallyl phthalate), and combinations comprising at least one of the foregoing resins.

61. An electrochemical cell component comprising;

a conductive core; and

an electrically and thermally conductive polybutadiene- or polyisoprene-based composite substantially covering and adhered to the core by an adhesion promoter, wherein linear shrinkage per unit length of the molded conductive polymer composite in the X-Y plane is less than or equal to about 0.005.

62. An electrochemical cell component comprising;

a conductive core; and

an electrically and thermally conductive polybutadiene- or polyisoprene-based composite substantially covering and adhered to the core by an adhesion promoter, wherein the polymer composite comprises conductive filler in the form of fibers, platelets, or a combination of fibers and platelets.